CLAIMS

What is claimed is:

1. A method of creating an electrical field-rectifying fractionation-ratchet, comprising:

obtaining a fractionated particle having an electrophoretic mobility that varies when an electric field varies;

applying a pulsed electrical field to the fractionated particle; and

varying a plurality of pulses of the pulsed electrical field repeatedly.

2. The method of claim 1, wherein the pulsed electrical field comprises one or more pulses that reverse a polarity of the electrical field and change a magnitude of the electric field.

3. The method of claim 1, wherein the pulsed electrical field comprises a square pulse having a magnitude E_H that lasts for a time t_H.

4. The method of claim 3, wherein the square pulse is followed by a second square pulse of a lower magnitude E_L and a longer time t_L.

5. A computer program, comprising computer or machine readable media translatable for implementing the method of claim 1.

6. An apparatus for performing the method of claim 1.

7. A method of preparative gel electrophoresis, comprising utilizing a continuous fractionation method comprising:

repeatedly loading a sample at a location in a gel; and

continuously collecting each fraction at a different location.

8. The method of claim 7, further comprising placing a barrier at both ends of a lane used to fractionate the sample.

9. The method of claim 8, wherein the barrier comprises a gel with a pore size sufficiently small to prevent the sample from entering the gel.

10. The method of claim 7, wherein loading a sample at the location in the gel comprises loading the sample in one sample well only.

11. The method of claim 7, wherein each fraction is collected either at a barrier in an E_H direction or at a barrier in an E_L direction.

12. The method of claim 7, wherein a continuum of fractions is generated by changing an angle separating an E_H pulse and an E_L pulse.

13. The method of claim 12, wherein the angle is made less than π radians.

14. The method of claim 12, wherein a magnitude of the E_H pulse and a magnitude of the E_L pulse are unequal.

15. The method of claim 7, wherein preparative gel electrophoresis utilizes a polyethylene-oxide separation matrix.

16. A computer program, comprising computer or machine readable media translatable for implementing the method of claim 7.

17. An apparatus for performing the method of claim 7.

18. A method of implementing cyclic electrophoresis, comprising:

analyzing a sample by constant field electrophoresis; and

enhancing the sample by an electrophoretic ratchet.

19. The method of claim 18, wherein the enhancement causes a migration of the sample in an opposite direction.

20. The method of claim 18, wherein the enhancement causes an increase in a separation between a plurality of bands of the sample.

21. The method of claim 18, wherein a t_H is varied while keeping a ratio t_H/t_L constant to avoid relaxation effects during the enhancement.

22. The method of claim 18, wherein the enhancement causes a sharpening of a plurality of bands of the sample.

23. The method of claim 18, wherein the enhancement causes the sample to migrate over an indefinite effective length.

24. The method of claim 18, wherein the analysis and the enhancement are repeated.

25. The method of claim 18, wherein cyclic electrophoresis utilizes a polyethylene-oxide separation matrix.

26. A computer program, comprising computer or machine readable media translatable for implementing the method of claim 18.

27. An apparatus for performing the method of claim 18.

28. A method of error checking during cyclic electrophoresis comprising:

analyzing a sample by constant field electrophoresis;

checking for errors in the sample; and

enhancing the sample by an electrophoretic ratchet.

29. The method of claim 28, further comprising analyzing the sample after enhancing the sample.

30. The method of claim 28, wherein cyclic electrophoresis utilizes a polyethylene-oxide separation matrix.

31. A computer program, comprising computer or machine readable media translatable for implementing the method of claim 28.

32. An apparatus for performing the method of claim 28.

33. A composition for a separation matrix for use in electrophoresis comprising:

a polyethylene-oxide (PEO);and

a buffer solution.

34. The composition of claim 33, wherein the PEO has a molecular weight of 8000000, 2000000, or 600000.

35. The composition of claim 33, wherein the separation matrix contains a 3% total concentration of PEO.

36. The composition of claim 35, wherein the separation matrix comprises 2% PEO of 8000000 molecular weight, and 1% PEO of 600000 molecular weight.